

6/1/98

## State Wetlands Protection Development Grant QUARTERLY REPORT

**Project Title:** Multi-Objective Approaches to Floodplain Management on a Watershed Basis

**Recipient Agency:** State of California, Department of Water Resources  
Division of Flood Management  
Floodplain Management Branch

**Grant Number:** EPA Assistance Agreement (Grant) ID No. CD999753-01-0. (DWR Contract #165833)

**EPA Project Officer:** Mary Butterwick, Coordinator

**DWR Project Manager:** Andy Lee, Chief, Floodplain Management Branch

**Date of Award:** September 22, 1997

**Dates Covered in Report:** October 1, 1997 through March 31, 1998

**Project Description:** To develop a comprehensive procedure to assist local officials implement multi-objective floodplain management on a watershed basis, focusing upon benefit/cost analysis which includes non-market evaluation techniques for wetland restoration and other environmental as well as societal benefits.

<b>Status of Funding:</b>	<u>Status</u>	<u>EPA</u>	<u>State</u>	<u>Total</u>
	Funds Awarded	\$318,000	\$137,000	\$455,000
	Funds Expended (1)	\$60,000	\$25,000	\$85,000
	Funds Remaining	\$258,000	\$112,000	\$370,000

*(1) May not match dollar amounts actually billed because of delay in obtaining Dept. of General Services approval and the establishment of work authority accounts.*

## Accomplishments

Accomplishments of the EPA floodplain management study to date include:

1. **Involvement of the Economic Analysis and Financial Assistance Section of DWR.** The EA&FA Section began regular attendance at the Interagency Floodplain Management Group's monthly meetings in October of 1997. The EA&FA Section will be responsible for developing the benefit/cost analysis portion of the *Floodplain Management Training Manual*, which is the primary output of this EPA study. To a great extent, the EA&FA Section will be borrowing heavily from their previous work in developing a benefit/cost analysis approach for agricultural efficient water management practices, which also includes a software package (currently being developed and tested) to be used by agricultural water suppliers.
2. **Revised Study Plan.** After the EA&FA Section became active in this study, the next four meetings of the IFMG were devoted primarily to further scoping of the study and revising the study plan presented in the original EPA grant proposal. These meetings generated considerable thoughtful discussion concerning the objectives of this study and the best ways to meet those objectives within the time and monetary constraints. Attachment #1 is the latest version of the study plan, which presents the study goals, study products and study tasks. Attachments #2 and #3 present the overall study schedule as well as a more detailed schedule for the EA&FA Section for its responsibilities. Attachment #4 provides more information concerning the study tasks, including priorities, EPA funding spent to date and the total expected to be expended, completion dates and specific task products.
3. **Web Site.** A web site has been established to enhance communication among the IFMG. The address of this website is: <http://www.dop.water.ca.gov/epastudy/>. This site contains information for upcoming meetings as well as the notes from previous meetings; documents for review (such as the study plan and schedules); field trip information and links to over 65 other websites related to flood and watershed management issues. To enter this site, a user name and password must be entered; both of these are the same word: epastudy. Attachment #5 is a printout of the home page of this site.
4. **Work in Progress.** Work has begun on a number of important tasks listed in the Study Plan, including:
  - a. *Study definitions/assumptions (Task II).* Because of the large number of federal/state/local and private entities that work with floodplain and watershed management issues, there are different definitions of some key terms that will be used in this study (watershed, floodplain, 100 year flood, etc.). Work is underway to identify a list of key words as well as the different definitions associated with those terms, and to select/modify/develop the most appropriate definition for this study.

- b. *Overview of multi-objective floodplain planning process (Task III).* The benefit/cost analysis to be developed by this study is just one step that must be completed in the overall floodplain management planning process. Therefore, the purpose of this task is to provide an overview of the benefit/cost analysis in relationship to the overall floodplain planning process so that planners can be aware of the steps that must be accomplished *before* and *after* the benefit/cost analysis is completed. If these steps are not taken, then the advantages of performing the benefit/cost analysis can not be fully realized. A draft recommended planning process flowchart is included in the revised study plan.
- c. *Evaluating economic benefits and costs (Task IV).* This is the most important task of the study, including (1) the identification of a benefit/cost analysis framework which shows the logic of the analysis and the required steps and (2) techniques for valuing benefits and costs, especially those which traditionally been the most difficult to evaluate (non-market benefits and costs). Although there is information in the watershed/floodplain literature concerning benefit/cost frameworks (and an example framework is included in the study plan), much of the work for this will probably begin in earnest once the advisory group of the UC Water Resources Center is in place (described below). As for the valuation of non-market benefits and costs, research has already begun which is described in more detail in Attachment 6. Also to be developed is a software program based upon the framework which will assist local planners in performing their benefit/cost analyses. Although work specific to this EPA study has not yet begun, the EA&FA Section is nearing the completion of a software program (using Visual Basic) for another study (the evaluation of agricultural efficient water management practices) that should facilitate the development of the floodplain management benefit/cost software program.
- d. *Guidelines for the State General Plan (Task V).* Guidelines for the State General Plan (Task V). The Governor's Office of Planning and Research is preparing new floodplain management guidelines to be used by local agencies in preparing their general plans. These guidelines will also be discussed in the *Floodplain Management Training Manual* being developed by this study, and OP&R has submitted its outline of information to be included in this manual. A contract has been executed between DWR and OPR for \$15,000 to accomplish this work. The revised study plan incorporates OPR's tasks, for which work is currently underway and should be complete by early May.
- e. *Reference Materials (Task VI).* A vast (and oftentimes confusing) amount of information is currently available that can be very relevant to the *Floodplain Management Training Manual*. Much of this information is currently available in databases prepared by various public and private entities. A goal of this study is to research these information sources and summarize them so that local planners can

make better use of them. This information includes

- i. Financial and technical assistance programs. There is a myriad of funding and technical assistance programs that are available from numerous public, non-profit and private organizations.. Although not specified in the original grant proposal, DWR will contribute funding to review and summarize these programs, and develop a database to assist local agencies in choosing the funding and/or technical assistance programs that best meet their needs. With the help of a EPA grant, the National Park Service has completed an initial database. We have obtained a copy of this database, and plan to build upon it (using either ACCESS or DBASE) so that it is easier for users to do searches for specific types of programs. We are also researching other financial and technical assistance databases and will incorporate this information as appropriate into our database. CALFED is pursuing a similar task related to their watershed program, so coordination with that program will be important.
- ii. Types of floodplain management measures/regional environmental characteristics. In order to more effectively perform the benefit/cost analysis that will be recommended by this study, local agencies will need to have access to a large amount of existing information concerning the environmental characteristics of their floodplains and the different flood control measures that might be implemented. Therefore, this study will summarize the many existing databases and other sources of information. To date we have identified and catalogued more than 19 databases sponsored by many different groups with relevant information and are currently reviewing these databases to (1) become knowledgeable about the information contained within them, (2) determine how useful it might be to local agencies, especially related to the geographic coverage ("specificity") of the information, and (3) determine how to access the information through the Internet or more traditional means. We have no intention of creating our own database of this information because there is no way we could (or should) duplicate the work that already has been accomplished by a large number of agencies. Instead, our goal is to summarize the existing information so that local agencies can more effectively make use of it for floodplain planning purposes. One of the tools we are using to summarize this information is a matrix that will display the relationship of the databases with over 40 different subjects, thus making it easier for local officials to determine which databases would be the most effective for their purposes. Once local agencies can identify the environmental characteristics potentially affected by different floodplain plans, then this information can be combined with the non-market valuation techniques described above.

5. **UC Water Resources Center Advisory Committee.** An advisory committee composed of relevant disciplines is being established through the UC Water Resources Center at Davis. A

small amount of funding (\$5,000) is being budgeted to cover administrative expenses of this committee. Although an initial meeting was held with Mr. Don Erman, the Director of the Center, committee members have not yet been identified. However, this should be accomplished by this summer. Tasks for this committee will include:

- a. Assist in the development of the benefit/cost evaluation framework.
  - b. Provide technical expertise on a variety of hydrologic/engineering related issues.
  - c. Provide expertise in valuing non-market benefits and costs.
  - d. Help identify where future work efforts should be directed.
6. **Field Trips.** To enhance our research efforts, field trips will be conducted periodically throughout the study period. The first two trips include a visit to the Cosumnes River Preserve, which is an excellent example innovative flood control methods and financing as well as ecosystem restoration sponsored by the Nature Conservancy. The Cosumnes River is an undamed river flowing west out of the Sierra Nevada mountain range and into the Sacramento-San Joaquin River Delta.. This field trip will be held on April 23. The second field trip will be to the Cache Creek Conservancy on May 13th. Cache Creek originates at Clear Lake in the coastal mountains and flows east into the Sacramento Valley near Woodland.
7. **Conferences.** In March, a couple of the members of the IFMG attended a UC Davis Extension conference *California Watersheds: Floodplain Management and Habitat Conservation*, which addressed many of the same issues as this study. Selected information presented at this conference can be incorporated into this study, especially relating to (1) funding and technical assistance programs offered by various agencies; (2) innovative flood control measures and (3) measuring the benefits of wetland habitat restoration programs.

## Deficiencies/Corrective Actions

Most of the focus to date has been on defining the types of information to be included in the *Floodplain Management Training Manual*, such as the benefit/cost analysis framework and the emphasis upon non-market valuation techniques. This has been a demanding task because of the comprehensive information that should be presented in this type of manual, but there are constraints due to the limited amount of resources to work with. So far less emphasis has been placed upon the steps required to present the manual to local agencies through workshops, which is reflected in the lesser amount of details shown in Tasks VIII and IX of the Study Plan. The EA&FA Section has experience in presenting workshops for local agencies, having participated in several in the 1980's to explain the benefit/cost analysis required for water conservation/ground water recharge project loans. In addition, the EA&FA Section will likely be involved in similar workshops in the near future to explain the benefit/cost computer program being developed for the agricultural efficient water management practices. As the work effort developing the *Floodplain Management Training Manual* progresses and we can further assess the demand for workshops in different parts of the State, we will devote more time to expanding Tasks VIII and IX on the Study Plan, as reflected in the discussion

below.

### **Planned Activities for Next Six Months**

Over the next six months, our work effort will focus upon the following:

- Complete an overview of the floodplain management planning process to illustrate the relationship of the benefit/cost analysis to the other steps in the overall planning process and prepare an initial draft of study key term definitions and assumptions;
- Actively involve the UC Water Resources Center advisory committee in our research efforts, specifically focusing upon the benefit/cost analysis framework and non-market valuation techniques;
- Completion of the initial draft of the Office of Planning and Research's Guidelines For The State General Plan;
- Continue research into existing databases (financial/technical resources, types of floodplain management measures, environmental characteristics);
- Begin work on computer software program, however, this work is dependent upon the progress in developing the benefit/cost analysis framework.;
- Conduct field trips to the Cosumnes River Preserve and the Cache Creek Conservancy;
- Attend *Water and Wetlands* conference in May sponsored by UC Berkeley Extension; and
- Further refine tasks required for local agency workshops.

### **List of Attachments**

Attachment 1: Study Plan

Attachment 2: Study Schedule

Attachment 3: Economics Study Schedule

Attachment 4: Study Task Priorities, Funding and Products

Attachment 5: Home Page of Website.

Attachment 6: Status of Non-Market Valuation Techniques

## ATTACHMENT 1

### **Study Plan: Multi-Objective Approaches to Floodplain Management On A Watershed Basis**

#### **Study Goals**

- A. Develop a comprehensive course concerning multi-objective floodplain management on a watershed basis for local agencies, with emphasis upon the use of benefit/cost analysis and the valuation of non-market effects
- B. Develop strategies and/or guidance on including multi-objective floodplain management into communities' General Plans
- C. Develop educational module for presentation at workshops and other outreach events to facilitate local multi-objective floodplain management on a watershed basis

#### **Study Products**

- A. Local agency *Floodplain Management Training Manual*:
  - 1. Multi-objective floodplain management planning process
  - 2. Implementation strategies and guidelines
  - 3. Economic (benefit/cost) analysis
  - 4. Non-market valuation techniques
  - 5. Data base of public and private technical and funding assistance programs (funded outside of this study--coordinate with NPS)
- B. State General Plan (Floodplain Management Element) guidelines
- C. Educational package (computer program, video, powerpoint presentation, written informational materials, etc.) and conduct statewide workshops
- D. Formation of economics support staff within DWR to provide technical assistance to local agencies (post study)

#### **Study Tasks**

- I. Study Scoping
  - A. Review original grant proposal
  - B. Monthly "brainstorming" meetings
  - C. Research similar studies conducted by others
  - D. UC Water Resources Center advisory committee
- II. Study Definitions/Assumptions
  - A. Multi-objective floodplain management planning
  - B. Physical characteristics
    - 1. Watershed
    - 2. Drainage area
    - 3. Floodplain
    - 4. On-site/upstream/downstream
  - C. Flood events
    - 1. Hydrology parameters
    - 2. Sediment parameters

- D. Natural floodplain functions
  - E. Floodplain management measures
    - 1. Traditional/non-traditional measures
    - 2. Alternative plans
  - F. Economic analysis vs. financial analysis
  - G. Economic analysis
    - 1. Benefits (direct and indirect)
    - 2. Costs (direct and indirect)
    - 3. Analysis period (long run vs. short run)
    - 4. Project area
    - 5. Discount rate
    - 6. With and without project conditions
    - 7. Project beneficiaries/stakeholders
    - 8. Economic decision criteria (net benefits, b/c ratio, internal rate of return, cost-effectiveness)
  - H. Financial analysis
    - 1. Project costs
      - a. Capital
      - b. Annual operations, maintenance and replacement
    - 2. Cost allocation
    - 3. Interest rates
    - 4. Repayment period
  - I. "Public trust" doctrine
- III. Multi-Objective Floodplain Management Planning Process
- A. What is multi-objective floodplain management?
  - B. Multi-objective floodplain planning process
    - 1. Identify problems and opportunities
    - 2. Identify existing characteristics
      - a. Physical/hydrologic
      - b. Socioeconomic
      - c. Environmental
    - 3. Identify stakeholders and objectives
      - a. Local
      - b. State
      - c. Federal
      - d. Private (businesses/landowners, etc.)
    - 4. Identify alternative floodplain management plans
      - a. Traditional measures
      - b. Non-traditional measures
    - 5. Evaluate alternative floodplain management plans
      - a. Expected conditions without proposed plan
      - b. Expected conditions with proposed plan
    - 6. Compare plans
    - 7. Select plan
      - a. Institutional requirements

- 8. Plan implementation and monitoring
- C. Implementation of Floodplain Management Planning
  - 1. Institutional issues
    - a. Identification of stakeholders
    - b. Fragmented political/policy decision making
    - c. Methods to overcome problems
  - 2. Financial issues
    - a. Distribution of benefits and costs by location/stakeholder group
    - b. Identify potential repayment strategies by location/stakeholder group

*Flowchart 1: Floodplain Management Planning Process*

IV. Evaluating Economic Benefits and Costs

- A. Current floodplain management benefit/cost approaches
  - 1. Federal approach (US Army Corps of Engineers)
    - a. Planning model
    - b. Plan evaluation accounts
      - (1) National economic development account
      - (2) Regional economic development account
      - (3) Environmental quality account
      - (4) Other social effects account
    - c. Types of plans
      - (1) NED Plan
      - (2) NER Plan
      - (3) Optimum Tradeoff Plan
    - d. Plan selection/Federal funding criteria
  - 2. United Nations Food and Agricultural Organization
    - a. Evaluation framework
    - b. Quantifying benefits
    - c. Valuing benefits
    - d. Plan selection criteria
  - 3. Waterways Restoration Institute
    - a. Evaluation protocol
    - b. Multi-objective planning
    - c. Collaborative planning
    - d. Cost sharing strategies
- B. Framework for understanding physical/economic relationships
  - 1. Identify/quantify potential physical effects of floodplain management measures
  - 2. Identify/quantify/value potential economic effects linked to physical effects
- C. Economic benefits
  - 1. Willingness-to-pay concept
  - 2. Market values
  - 3. Non-market values
  - 4. Typical floodplain management benefits
    - a. Economic productivity
    - b. Flood damage/disaster payments reduction

- c. Navigation
  - d. Hydroelectric power production
  - e. Recreation
  - f. Health
  - g. Ecosystem quality
- 5. Distribution of benefits by location and over time
- D. Economic costs
  - 1. Opportunity costs
  - 2. Project capital costs
  - 3. Project annual operations, maintenance and replacement costs
  - 4. Distribution of costs by location and over time
- E. Measuring and Valuing Non-Market Benefits
  - 1. Unit day values
  - 2. Travel cost method
  - 3. Contingent valuation method
  - 4. Hedonistic method
  - 5. Other methods
  - 6. Benefit transfers
- F. Uncertainty
  - 1. Sources of uncertainty
  - 2. Effects of uncertainty
  - 3. Methods to reduce risks of uncertainty
- G. Plan selection criteria
  - 1. Benefit/cost ratio
  - 2. Net benefits
  - 3. Other

*Flowchart 2: Floodplain Management Economic Analysis Framework*

*Table 1: Floodplain Management Plan Evaluation Summary*

- V. Guidelines For The State General Plan
  - A. Introduction to floodplain management
  - B. Relationship to General Plan
  - C. Interrelationship and requirements for consistency with other General Plan Elements
  - D. Methodology
  - E. Relevant issues
  - F. Ideas for data and analysis
  - G. Ideas for development policies
  - H. Implementation
  - I. Examples
  - J. Agency and informational resources
- VI. Reference Materials
  - A. California floodplain management case studies
    - 1. Sacramento River Watershed Management Plan (USACE)

- 2. San Joaquin Mainstream Tributaries (USACE)
  - 3. Napa River
- B. Data bases of floodplain management measures
  - 1. Non-traditional
  - 2. Traditional
- C. Data bases of regional environmental characteristics
  - 1. CERES
  - 2. ICE
- D. Data bases of public and private funding/technical assistance programs (coordinate with NPS)
- E. List of related web sites
- F. Bibliography

#### VII. Benefit/Cost Software Program

- A. Computer program (likely to be in Visual Basic)
- B. Manual
- C. Example B/C analysis  
(To be determined--possible candidates: Cosumnes River, Cache Creek)

#### VIII. Training Materials

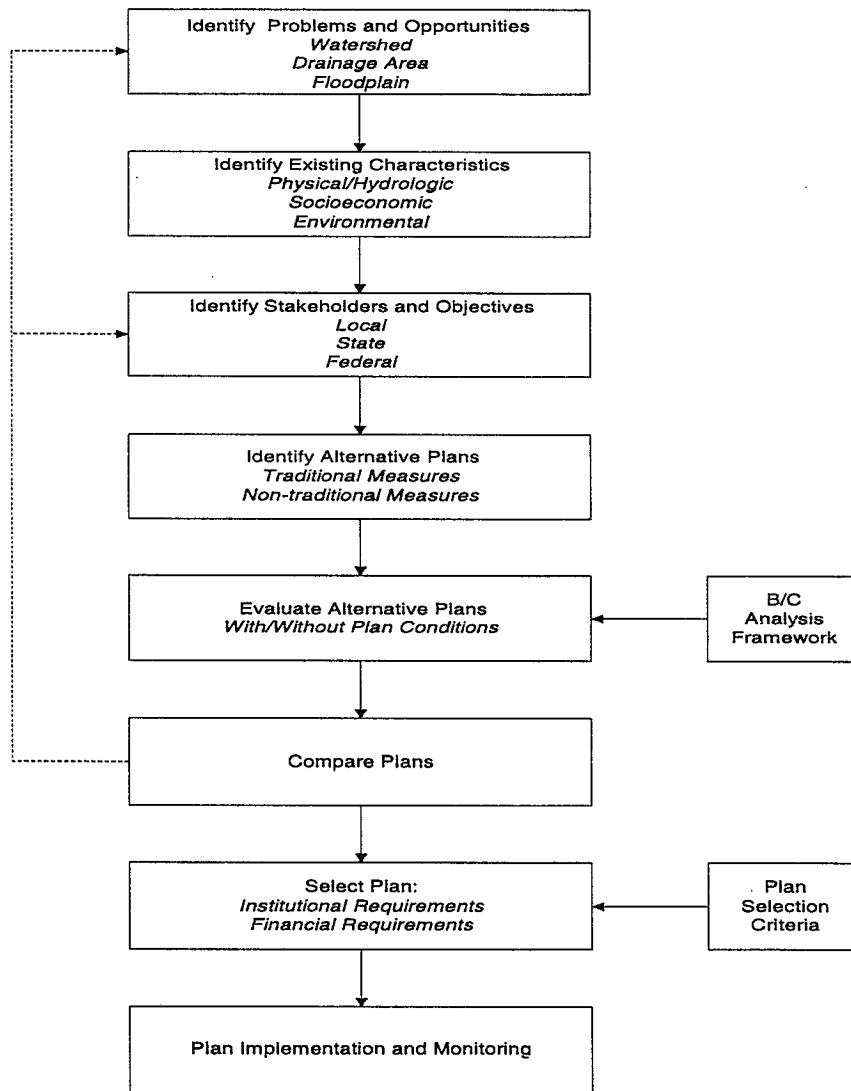
- A. Floodplain Management Training Manual
- B. Multi-media informational materials
  - 1. Powerpoint
  - 2. Videos
  - 3. Written brochures and other handouts
- C. Web site

#### IX. Workshops

- A. Identify team of trainers
- B. Identify locations of workshops
- C. Schedule of workshops

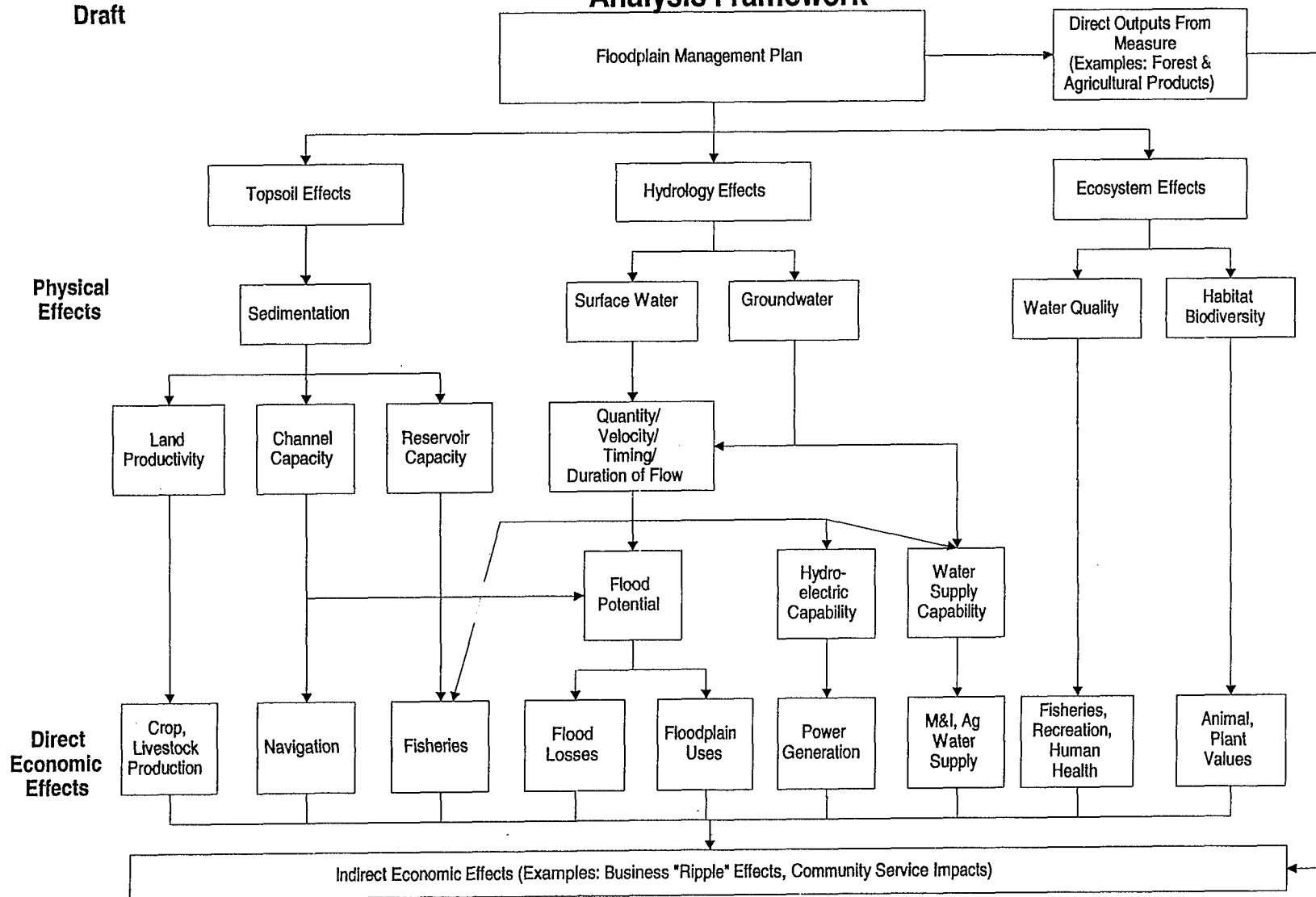
#### X. Final Report

## Flowchart 1: Floodplain Management Planning Process



**Flowchart 2: Example Floodplain Management Economic Analysis Framework \***

6/1/98  
Draft



\* Modified from FAO Conservation Guide "Guidelines for Economic Appraisal of Watershed Management Projects"

### Floodplain Management Plan Evaluation Summary Table

Types of Economic Effects	Location of Effects			Timing of Effects		Measurement of Effects				Federal Account				
	Up- stream	Onsite	Down- stream	Short- Term	Long- Term	Direction +   -   ?			Magnitude (Units)	Value (\$)	NED	RED	EQ	OSE
Ecosystem Quality Water Quality Habitat Quality														
Economic Productivity Flood Protection Water Supply														
Hydroelectric Power														
Recreation														
Navigation														

# Multi-Objective Approaches To Floodplain Management On A Watershed Basis: Study Schedule

Study Task	Description	Section	1997				1998				1999				2000			
			1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
I	Study Scoping	Group/Econ																
II	Definitions/Assumptions	Group/Econ																
III	Multi-Objective Floodplain Mgmt Planning Process/Econ	Group/Econ																
IV	Evaluating Economic Benefits and Costs	Economist																
V	Guidelines For The State Plan	OPR																
VI	Reference Materials	Economist																
VII	Benefit/Cost Computer Software	Group/Econ																
VIII	Training Materials	Group/Econ																
IX	Workshops	Group/Econ																
X	Final EPA Report	Group/Econ																

## ATTACHMENT 4

## Study Task Priorities, Funding and Products

Task No.	Task Description	Task Priority	Expenditures As Of 3/10/08 (\$1,000s)			Total Study Expenditures (\$1,000s)			Comp. Date	Task Product
			State	ITA	Total	State	ITA	Total		
I	Study Scoping	1	\$0	\$15	\$15	\$10	\$15	\$25	200	Study Plan
II	Administrative Arrangements	4	\$1	\$0	\$1	\$0	\$10	\$11	608	Task assignments and calendars*
III	Methods/Objective/Design/Plan/Planning Process	7	\$1	\$1	\$2	\$1	\$11	\$13	608	Step-by-step procedure, flowchart*
IV	Evaluating Economic Benefits and Costs	2	\$1	\$10	\$11	\$15	\$11.0	\$22.5	2008	Willingness to pay surveys, cost-benefit evaluation techniques*
V	Guidelines For The State Council Plan	3	\$1	\$0	\$1	\$0	\$15	\$16	508	Step-by-step procedure, sample selection*
VI	Software Platforms	6	\$10	\$10	\$20	\$10	\$10	\$40	1008	Case studies, databases, websites, literature, by computer program, webinars, sample for analysis*
VII	BC Software program	7	\$0	\$0	\$0	\$15	\$0	\$15	200	Computer program, webinars, sample for analysis*
VIII	Training Materials	8	\$0	\$0	\$0	\$25	\$0	\$25	609	Powerpoint presentation, videos, handouts
IX	Workshops	9	\$0	\$0	\$0	\$20	\$0	\$20	200	Location schedules to be determined
X	Administrative Information	11	\$1	\$0	\$1	\$10	\$0	\$11	608	Summary of study, conclusions, recommendations for future work
Total			\$28	\$28	\$56	\$185	\$318	\$445	4000	Final Management Training Manual

## ATTACHMENT 5

### Welcome to Information Interchange Page for the EPA Grant-Funded Floodplain Management Study

#### Latest Meeting Information

##### Upcoming Interagency Floodplain Management Group Meeting:

Date: Tuesday, May 12, 1998

Time: 10:00 a.m. - 3:00 p.m.

Location: Room 210, Resources Building, 1416 9th St., Sacramento

Agenda Not yet available

Previous meeting's Agenda

Notes From Previous Interagency Floodplain Management Group Meetings

#### Latest Documents Available for Review

##### Latest Version of Study Plan

Wordperfect

MS Word

Gregg McKenzie has prepared this outline of the work to be performed by the Office of Planning and Research. This outline has been incorporated into the study plan available above.

Watershed Management Flow Charts

Economic Study Schedule

Overall Study Schedule

Proposed UC Water Resources Center Task Request and Committee Composition

#### Field Trip Information

Cosumnes River      Date: April 23, 1998 Details forthcoming

The Cosumnes River Preserve: Large-Scale Ecosystem Restoration in the Sacramento-San Joaquin Delta. This site is sponsored by the Nature Conservancy, and contains information about a major floodplain restoration and protection project.

Cache Creek      Date: Early May 1998 Details forthcoming

Cache Creek Conservancy Ann Brice, Executive Director, Cache Creek Conservancy

Cache Creek Environmental Restoration Reconnaissance Study The purpose of the study is to investigate the potential for environmental restoration along the Cache Creek corridor, in particular, the rehabilitation of gravel pits along Cache Creek into wetland habitat.

#### Links to Other Watershed Management-Related Websites

Please provide us with comments or suggestions (or requests):

Submit Comment/Request Form (Netscape ver. 4+ Only)

E-Mail to [scowdin@water.ca.gov](mailto:scowdin@water.ca.gov)

## ATTACHMENT 6

### **Status of Non-Market Valuation Techniques**

Because of the many “non-market” environmental outputs (such as creation/reservation of wetlands and recreational opportunities) that can be associated with floodplain planning, a critical element of developing a benefit/cost analysis is the incorporation of non-market valuation techniques. If this study is successful in recommending approaches for valuing environmental and other non-market outputs of floodplain projects, then it will have contributed significantly to floodplain planning. Two overall different approaches are cited in the literature for economic analysis of non-marketed benefits: site specific original studies and benefit transfers.

Conducting original studies might not be feasible for local agencies due to the time limitation and budgetary constraints. Original studies necessitate the lengthy process of data collection, pre-tests, analysis, and report writing. There is also the “site-specific” problem which may result in biased inferences if the findings of the study are to be applied to other non-homogenous study areas. The best alternative given these constraints is a benefit transfer. A benefit transfer is an application of a data set and results developed for a particular study area (study site) to another study area (policy site). In employing this method, care must be taken so that the physical and socioeconomic characteristics of the policy sites are very similar to that of the study sites. Three classes of benefit transfer are identified in the literature: (1) value estimates based on expert opinion; (2) value estimates based on observed behavior (e.g. travel cost method); and (3) value estimates based upon preference elicitation (contingent valuation method).

Other benefits to be considered (either market or non-market) are consumptive uses (hunting, fishing), non-consumptive uses (hiking, camping), and indirect uses (reading books or watching movies about nature). Non-use values such as option value and existence value should also be considered.

A comprehensive survey of the literature to collect the results of relevant studies is currently in progress, and a critical review of various non-market methodologies has already been prepared.

Specific outputs for this research include brief descriptions of the various original valuation techniques (such as travel cost and contingent valuation) that can be employed by local agencies if they have the resources to do these types of studies. However, because it is likely the local agencies will not have the resources to do original work, this study will focus upon the pros and cons of doing benefit transfers as well as relevant data sources. Once a site for the pilot study is selected, a range of non-market benefits which are applicable to the physical and socioeconomic characteristics of the study site will be generated to illustrate how the process works.